

CLAIMS

What is claimed is:

1. A method of image analysis comprising:
providing image data representative of a set of images of a spray plume,
5 each of the images being representative of a density characteristic of the spray
plume along a plane that intersects the spray plume; and
measuring one or more spray plume parameters associated with the spray
plume within one or more of the images.
2. A method according to claim 1, wherein the one or more parameters includes the
10 central axis of the spray plume.
3. A method according to claim 2, wherein the one or more parameters further
includes an angle measured from the central axis of the spray plume to an outer
boundary of the spray plume.
4. A method according to claim 1, wherein the one or more parameters includes
15 one or more cross-sectional axes of the spray plume.
5. A method according to claim 1, further comprising:
defining a shape on the one or more images so as to delineate an area of
the spray plume; and
measuring one or more spray plume parameters within the area.
- 20 6. A method according to claim 5, wherein the spray plume parameters are selected
from the group consisting of area start X and Y coordinates, area end X and Y
coordinates, area width, area height, mean spray intensity, spray standard

deviation, minimum spray intensity, maximum spray intensity, and spray intensity histogram.

7. A method according to claim 5, wherein the spray plume parameters are selected from the group consisting of the area major and minor elliptical diameters, angle of the area elliptical axes, geometrical ratio, elliptical ratio, and spray intensity profiles along the major and minor axes.
5
8. A method according to claim 5, further comprising using an intensity threshold for defining the borders of the shape.
9. A method according to claim 1, further comprising:
10 defining a line on the one or more images so as to delineate an axis of the spray plume; and
 measuring one or more spray plume parameters along the axis.
10. A method according to claim 9, wherein the spray plume parameters are selected from the group consisting of axis start X and Y coordinates, axis end X and Y coordinates, axis length, axis width, axis height, axis angle, mean spray
15 intensity, spray standard deviation, minimum spray intensity, maximum spray intensity, and spray intensity profile.
11. A method according to claim 1, further comprising using one or more calibrating components to associate physical coordinates with image coordinates within
20 each of the set of images.
12. A method according to claim 11, further comprising defining an origin point to associate physical coordinates with image coordinates within each of the set of images.

13. A method according to claim 1, further comprising:
 - integrating the set of images so as to exhibit a summary representation of the images; and
 - measuring one or more parameters of the summary representation.
- 5 14. A method according to claim 13 further comprising:
 - providing image data representative of a background image; and
 - before integrating the set of images, subtracting the background image from all images in the set of images.
- 10 15. A method according to claim 14, wherein the summary representation of images corresponds to an axial cross-sectional density characteristic along a plane substantially normal to a flow direction centerline of the spray plume.
16. A method according to claim 14, wherein the summary representation of images corresponds to a longitudinal density characteristic along a plane substantially parallel to and intersecting a flow direction centerline of the spray plume.
- 15 17. A method according to claim 1, wherein at least one of the images corresponds to a cross-sectional density characteristic along a plane substantially normal to a flow direction centerline of the spray plume.
18. A method according to claim 1, wherein at least one of the images corresponds to a longitudinal density characteristic along a plane substantially parallel to and
20 intersecting a flow direction centerline of the spray plume.
19. A method according to claim 1, further comprising
 - providing image data representative of a background image; and

subtracting the background image from at least one image of the set of images.

20. A system for analyzing image data representative of a set of images of a spray plume, each of the images being representative of a density characteristic of the spray plume along a plane that intersects the spray plume, comprising:
- 5 a processing device for receiving the set of images; and,
a controller, associated with the processing device, that provides a user interface for controlling the processor to measure one or more spray plume parameters associated with the spray plume within one or more of the images.
- 10 21. A system according to claim 20, wherein the one or more parameters includes the central axis of the spray plume.
22. A system according to claim 21, wherein the one or more parameters further includes an angle measured from the central axis of the spray plume to an outer boundary of the spray plume.
- 15 23. A system according to claim 20, wherein the one or more parameters includes one or more cross-sectional axes of the spray plume.
24. A system according to claim 20, wherein the controller further (i) defines a shape on the one or more images so as to delineate an area of the spray plume, and (ii) measures one or more spray plume parameters within the area.
- 20 25. A system according to claim 24, wherein the spray plume parameters are selected from the group consisting of area start X and Y coordinates, area end X and Y coordinates, area width, area height, mean spray intensity, spray standard

deviation, minimum spray intensity, maximum spray intensity, and spray intensity histogram.

26. A system according to claim 24, wherein the spray plume parameters are selected from the group consisting of the area major and minor elliptical diameters, angle of the area elliptical axes, geometrical ratio, elliptical ratio, and spray intensity profiles along the major and minor axes.
27. A system according to claim 24, wherein the controller uses an intensity threshold for defining the borders of the shape.
28. A system according to claim 20, wherein the controller further (i) defines a line on the one or more images so as to delineate an axis of the spray plume, and (ii) measures one or more spray plume parameters along the axis.
29. A system according to claim 28, wherein the spray plume parameters are selected from the group consisting of axis start X and Y coordinates, axis end X and Y coordinates, axis length, axis width, axis height, axis angle, mean spray intensity, spray standard deviation, minimum spray intensity, maximum spray intensity, and spray intensity profile.
30. A system according to claim 20, wherein the controller is capable of calibrating components for associating physical coordinates with image coordinates within each of the set of images.
31. A system according to claim 30, wherein the controller is capable of defining an origin point to associate physical coordinates with image coordinates within each of the set of images.

32. A system according to claim 20, wherein the processor further integrates the set of images so as to exhibit a summary representation of the images for measuring one or more parameters of the summary representation.
- 5 33. A system according to claim 32 wherein the processor, before integrating the set of images, subtracts a background image from all images in the set of images.
34. A system according to claim 33, wherein the summary representation of images corresponds to an axial cross-sectional density characteristic along a plane substantially normal to a flow direction centerline of the spray plume.
- 10 35. A system according to claim 33, wherein the summary representation of images corresponds to a longitudinal density characteristic along a plane substantially parallel to and intersecting the flow direction centerline of the spray plume.
36. A system according to claim 20, wherein at least one of the images corresponds to a cross-sectional density characteristic along a plane substantially normal to a flow direction centerline of the spray plume.
- 15 37. A system according to claim 20, wherein at least one of the images corresponds to a longitudinal density characteristic along a plane substantially parallel to and intersecting a flow direction centerline of the spray plume.
38. A system according to claim 20, wherein the processor further subtracts a background image from at least one image of the set of images.
- 20 39. A system according to claim 20, wherein the processing device includes a computer system executing software operative to analyze the image data.

40. A method of image analysis comprising:
providing image data representative of a set of images of a spray plume,
each of the images being representative of a density characteristic of the spray
plume along a plane that intersects the spray plume; and
5 displaying the set of images so as to exhibit a time evolution of the spray
plume along the plane.
41. A system for analyzing image data representative of a set of images of a spray
plume, each of the images being representative of a density characteristic of the
spray plume along a plane that intersects the spray plume, comprising:
10 a processing device for receiving the set of images; and,
a controller, associated with the processing device, that provides a user
interface for controlling the processor to display the set of images so as to
exhibit a time evolution of the spray plume along the plane.